EXHIBIT F-1

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF MISSOURI

Asarco LLC

v.

NL INDUSTRIES, INC., et al.

Case No. 4:11-CV-00864-JAR

EXPERT REPORT

OF

(Paul V. Rosasco, P.E.)

January 27, 2014

I. INTRODUCTION AND SUMMARY OF OPINIONS

This report presents the opinions that I, Paul V. Rosasco, P.E., anticipate providing at the trial of this matter. I have been requested to provide expert opinions on behalf of Asarco LLC ("Asarco").

A summary of my opinions, to a reasonable degree of scientific certainty, is as follows:

A. Union Pacific Railroad owns or its predecessors owned railroad lines within St. Francois and Madison Counties that were used to haul ore and other materials to and from the historic mining sites located in the Southeast Missouri Lead District ("SEMO").
B. The railroad track ballast and in some instances the grades of these railroad lines were constructed using mining-related waste materials, specifically chat.
C. Chat contains hazardous substances including cadmium, lead and zinc.
D. Erosion of and dissolution of metals from the railroad track ballast has resulted in release, or threat of release of cadmium, lead and zinc to surface water and sediment.
E. The U.S. Environmental Protection Agency has used funds provided by Asarco to conduct response actions to address occurrences of cadmium, lead and zinc in surface water and sediment within St. Francois and Madison Counties.

This report is based on data available at the time it was prepared and my work is continuing. I reserve the right to amend or revise my opinions as further information becomes available, including but not limited to review of environmental data obtained by Defendants or Defendants' experts when it becomes available, review of additional documents that Plaintiff's Counsel have requested from the Defendants, and deposition

transcripts of the Defendants' employees, representatives and experts and fact witnesses in this matter. I also reserve the right to express new opinions in response to new information or in response to opinions that may be expressed by Defendants' experts.

II. QUALIFICATIONS AND PUBLICATIONS

I am a geologist, hydrogeologist and civil engineer and have been working on investigation and remediation of contaminated sites and radioactive disposal sites for over 30 years. I have been responsible for and involved in the performance of Remedial Investigations ("RI"), Feasibility Studies ("FS"), Remedial Design ("RD") and Remedial Action ("RA") at Superfund sites for 30 years. I have also been responsible for investigation and assessment of hazardous waste facilities and corrective actions at sites regulated under the Resource Conservation and Recovery Act ("RCRA") or state-equivalent Superfund and hazardous waste corrective action programs.

My experience includes evaluation of existing data and development of scopes of work; negotiation of scopes of work, administrative orders and consent decrees; implementation and supervision of remedial investigations, treatability studies, feasibility studies, remedial designs, remedial actions, and removal actions; operations and maintenance ("O&M") of remedial and removal actions; and performance and effectiveness evaluations of O&M activities. I have performed these activities at a variety of Superfund and RCRA sites.

I have been qualified by several federal courts as an expert in the areas of hydrogeology, contaminant occurrence, fate and transport, remedial action technologies, site remediation, costs of remedial actions, and consistency of site investigations and

remedial actions with the National Contingency Plan ("NCP"). A copy of my current curriculum vitae, including a list of publications, is included as Attachment 1 to this report. A listing of cases in which I have provided expert testimony during deposition or at trial during the last four years is included in Section VII of this report.

III. DATA AND OTHER SOURCES OF INFORMATION CONSIDERED

In addition to my education, experience and training, I considered the documents listed in Attachment 2. I also travelled to and inspected various active and abandoned railroad lines in St. Francois and Madison Counties on December 3, 2013.

IV. STATEMENT OF OPINIONS; BASIS AND REASONS FOR OPINIONS

A. Union Pacific Railroad owns or its predecessors owned railroad lines within St. Francois and Madison Counties that were used to haul ore and other materials to and from the historic mining sites located in Southeast Missouri

The Southeast Missouri Lead District is located in southeastern portion of the state near the towns of Bonne Terre, Farmington, and Fredericktown, approximately 80 miles south of St. Louis. Three lead/zinc sub-districts (Old Lead Belt, Mine La Motte-Fredericktown, and Viburnum Trend) and several minor sub-districts are located in a region referred to as the Southeast Missouri Lead District (U.S. Geological Services, 2008). Arsenic, cadmium, cobalt, copper, lead, nickel, and zinc are the primary trace elements associated with the sulfide minerals of the Mississippi Valley Type ore deposits present in the district (U.S. Geological Services, 2008). The railroad lines that served the Old Lead Belt mining district in St. Francois County and the Mine LaMotte-

Fredericktown district in adjacent Madison County portions of SEMO are of particular interest for this report.

The first railroad constructed in St. Francois County was the St. Louis & Iron Mountain & Southern Railroad (also referred to as the St. Louis, Iron Mountain & Southern Railroad or the St. Louis and Iron Mountain Railroad) which in 1859 completed a line from St. Louis to Pilot Knob (near Ironton) in Iron County (Akers, 1938, NewFields, 2007, Friends of Steam Railroading, 2012). The line was constructed to facilitate transportation of iron ore to St. Louis (Akers, 1938, NewFields, 2007, Friends of Steam Railroading, 2012). This line entered the western portion of St. Francois County near Bismarck and continued south through St. Francois County to Pilot Knob in Iron County (Asher & Adams, 1872, G.W. & C.B. Colton & Co., 1873, 1876, 1881, and 1882, Higgins & Co., c1887, Galbraith, c1898, Akers, 1938, New York, 185?, Keeler, 1867, Heubach, 1879, Rand, McNally & Co., 1882, 1883, and 1892, Knight, Leonard & Company, 1892, and Friends of Steam Railroading, 2012). The first extension of the St. Louis & Iron Mountain & Southern (the Belmont Branch) was completed in 1869 and ran 120 miles from Bismarck in St. Francois County through St. Francois, Madison and Bollinger Counties to Allenville in Cape Girardeau County and further to the southeast through Scott County to the town of Belmont (Asher & Adams, 1872, G.W. & C.B. Colton & Co., 1873, 1876, 1881, and 1882, Higgins & Co., c1887, Galbraith, c1898, Akers, 1938, New York, 185?, Keeler, 1867, Heubach, 1879, Rand, McNally & Co., 1882, 1883, and, 1892, Knight, Leonard & Company, 1892, and Friends of Steam Railroading, 2012).

Additional lines were constructed by the St. Louis & Iron Mountain & Southern and by other railroad companies including the St. Joe & Desloge Railroad, Mississippi River and Bonne Terre Railroad ("MR&BTRR"), St. Francois County Electric Railroad, and the Illinois Southern Railroad, among others, to facilitate movement of materials and traffic developed by the lead mining industry in SEMO (NewFields, 2007, Missouri State Historical Society CP-Hill Collection 1903-1950, and Public Service Commission of the State of Missouri, 1914).

The MR&BTRR was formed on May 11, 1888 (Missouri-Illinois Railroad, 2012) and constructed a line from Bonne Terre to Riverside in Jefferson County and later extended the line from Bonne Terre to Doe Run (Mississippi River and Bonne Terre Railroad, 2012, Galbraith, c1898). MR&BTR built a branch line to Leadwood and there were many additional miles of feeders, switches and sidings (Mississippi River and Bonne Terre Railroad, 2012). The MR&BTRR passed through the towns of Bonne Terre, Desloge, St. Francois, Flat River, Rivermines, Elvins and Doe Run (Mississippi River and Bonne Terre Railroad, 2012). The MR&BTRR later purchased the St. Francois County Electric line (Akers, 1938).

The Missouri Pacific Railway was created in 1876 by investors who purchased the Pacific Railroad (UP, Chronological History, 2013). In 1881, the Missouri Pacific gained control of the St. Louis & Iron Mountain & Southern Railroad and in 1917 the two railroads were reorganized and merged into the Missouri Pacific Railroad Company (UP, Chronological History, 2013, and Parks, 2011a). In 1929, the Missouri Pacific bought controlling interest in the Missouri-Illinois R.R. Co. (formerly the Illinois Southern which itself was a consolidation of the Illinois Southern and the Southern

Missouri Railway) which also leased the MR&BTRR (Akers, 1938, Missouri-Illinois Railroad, 2012, and Parks, 2011a).

The Missouri Pacific gained controlling interest of both the Missouri-Illinois and the MR&BTRR on July 1, 1929 (Akers, 1938, Parks, 2011a, and Parks, 2011b). Specifically, the Missouri-Illinois filed an application with the Interstate Commerce Commission ("ICC") to acquire control of the MR&BTRR and the Missouri Pacific filed an application with the ICC to acquire control of the Missouri-Illinois (ICC, 1929). The ICC subsequently approved both applications (ICC, 1929). In 1945, the Missouri-Illinois filed an application with the ICC to purchase the MR&BTRR and said application was subsequently approved by the ICC (ICC, 1945). In 1956, after 23-years in trusteeship, the Missouri Pacific was reorganized and the various Gulf Coast Lines (*e.g.*, NOTM) were absorbed into the Missouri Pacific (Parks, 2011a). On November 1, 1978, the Missouri-Illinois was merged into the Missouri Pacific (Parks, 2011a and 2011b).

In 1980, the Union Pacific, Missouri Pacific, and Western Pacific railroads filed merger applications with the ICC which subsequently approved the merger in 1982 (UP, Chronological History, 2013). On January 1, 1997, the Missouri Pacific Railroad legally merged into the Union Pacific Railroad ("UPRR") with UPRR remaining as the surviving corporation (UP, Chronological History, 2013). Consequently, UPPR is the ultimate successor in the ownership of the various rail lines within St. Francois and Madison Counties.

Nearly all of the rail lines in St. Francois and Madison Counties are or were owned by Union Pacific or its predecessors (Figure 1 in Attachment 3). Some of these railroad lines are still in use today by Union Pacific while others were previously

abandoned by Union Pacific or its predecessor Missouri Pacific (Figure 1). Railroad lines within St. Francois County that are still in use or that have not been abandoned include:

- the former St. Louis, Iron Mountain and Southern line from St. Louis to Pilot Knob;
- portions of the former MR & BTRR line from Bonne Terre to Derby and portions of the Hoffman branch; and
- the former Illinois Southern line from Bismarck to St. Genevieve.

All of these lines are owned and operated by Union Pacific (IDOT, 2006). These lines are shown on Figure 1 as solid lines with yellow highlighting indicating they are owned by Union Pacific.

Railroad lines within St. Francois and Madison Counties that have been abandoned by Union Pacific, Missouri Pacific or their predecessors include:

- the former St. Louis, Iron Mountain Southern Railroad's Belmont Branch (subsequently owned by Missouri Pacific) that previously extended from Bismarck to Knob Lick, into Madison County, through Fredericktown southeast to Marquand and then through Bollinger County to Belmont/Whitewater (ICC, 1972, 1970a and 1970b);
- most of the former MR&BTRR line that extended from Valles Mines just north of St. Francois County to Bonne Terre (ICC, 1968);
- a 1.1 mile section of the former St. Joe Railroad and former MR&BTRR lines adjacent to the Bonne Terre Industrial Lead site (Union Pacific, 2000a and 2000b);

- the former MR&BTRR Turpin Branch that extended Derby south to Turpin (ICC, 1941a and 1941b);
- the former MR&BTRR Gumbo and Mitchell Branches out of Elvins;
- much of the former MR&BTRR Hoffman Branch to Leadwood (ICC, 1965);
- the former MR&BTRR Crawley Branch that extended east from near Flat River; and
- the former St. Francois County Electric line that extend from near Flat River to DeLassus where it connected with the former MR&BTRR Belmont Branch.

The locations of the abandoned lines are shown as dashed lines on Figure 1 with those previously owned by Union Pacific, Missouri Pacific or their predecessors highlighted in yellow.

B. The railroad track ballast and in some instances the grades of these railroad lines were constructed using mining-related waste materials, specifically chat.

Track ballast for the various railroad lines within St. Francois and Madison counties was constructed exclusively or predominantly from chat (MSHS CP-Hill Collection, 1903-1950, Missouri Public Service Commission, 1914, Hamilton, 1915, Missouri Bureau of Geology and Mines, 1921, The Doe Run Company, 2003, and NewFields, 2007). In addition, chat was used almost exclusively where large quantities of fill were needed to meet grade requirements (NewFields, 2007). Furthermore, Missouri Pacific stated that approximately 30 miles of the St. Louis, Iron Mountain &

Southern Railroad Belmont Branch line was constructed using tiff (a local term used in southeast Missouri to describe lead-bearing barite rock) and rock tailings (ICC, 1970a).

Chat is a term applied at the lead and zinc mines of Missouri to mine tailings or waste after the mineral content has been removed (Missouri Bureau of Geology and Mines, 1921, EPA, 2012a). Ore production in the SEMO consisted of crushing and grinding the rock to standard sizes and separating the ore (EPA, 2007a). Ore processing accomplished using dry gravity separation produced a fine gravel waste commonly call "chat" that typically ranges in diameter from ¼ to $^{5}/_{8}$ inches (EPA, 2007a). Wet washing or floatation separation of ore resulted in the creation of sand and silt size material called tailings.

Chat is ore bearing rock, broken into small angular pieces averaging ¼ in. to ½ in. in diameter (Hamilton, 1915). It is refuse from the jigs at the lead and zinc mines after the mineral has been separated from the stone (Hamilton, 1915).

In the southeastern mining districts of Missouri, chats were chiefly composed of dolomite (Missouri Bureau of Geology and Mines, 1921). Dolomite is a variety of limestone or marble rich in magnesium carbonate (Bates and Jackson, 1980). Crushed limestone is reported (Hamilton, 1915) to make the best ballast under any traffic, or in any locality. Chat ballast was used for ballast by all of the railroads entering the mining districts of Missouri, Kansas, Oklahoma and Arkansas and was transported hundreds of miles (Hamilton, 1915).

During my December 2013 visit to the SEMO area and inspection of various abandoned and active railroad beds, I observed the presence of coarse sand/fine gravel consistent with chat/mining waste in the ballast of the rail beds and as fill material

beneath railroad grades and within bridge abutments. Photographs of some of the locations I visited are contained in Attachment 3.

As discussed further below, the results of environmental sampling further support the presence of chat/mining waste within the railroad ballast, embankment, and bridge abutment materials along active and abandoned rail lines in St. Francois and Madison Counties. Specifically, samples of railroad ballast obtained by NewFields in 2006 (NewFields, 2007) and Asarco in 2013 contained elevated levels of cadmium, lead and zinc. In addition, the ratio of zinc to cadmium in the various samples of railroad ballast obtained by NewFields and Asarco are comparable to the zinc to cadmium ratios reported for the mill waste from the six large mining waste piles in St. Francois County (NewFields, 2007 and 2006).

C. Chat contains hazardous substances including cadmium, lead and zinc.

In 1992, EPA listed the Big River Mine Tailings/St. Joe Minerals Corp. site on the National Priorities List (EPA, 2012b). In 1997, EPA issued an Administrative Order on Consent to The Doe Run Resources Corporation and ASARCO Incorporated for performance of a Remedial Investigation/ Feasibility study for the St. Francois County mined areas (EPA, 1997a). A Focused Remedial Investigation was completed by NewFields (2006).

In a July 17, 2006 meeting, the EPA requested that The Doe Run Company conduct an investigation to characterize historic railroads in St. Francois County, with specific attention given to cadmium, lead, and zinc content in the ballast material and the volume of ballast (NewFields, 2007). A field investigation was conducted on November

14-17, 2006 following agency review (MDNR, 2006a) of a Field Sampling Plan (RRFSP) dated October 16, 2006 (NewFields, 2007). Thirteen (13) locations along the historic railroads were identified in the RRFSP to assess the cross-sectional area and sample remaining railroad ballast (NewFields, 2007). NewFields reports that no clear evidence of a railroad could be found at the HRR-7 location, so the HRR-14 location was added upon obtaining access (NewFields, 2007). Of the 13 transects, 12 were sampled and cross sections were measured at 13 locations and additional field volume estimates were made at three other locations (NewFields, 2007). All transect locations were on private land or within St. Joe State Park and access was obtained by The Doe Run Company prior to inspection (New Fields, 2007).

The results of the track ballast sampling and volume estimation efforts were presented in the draft Historic Railroads – St. Francois County Mined Areas report prepared by NewFields and dated January 29, 2007. A copy of the table in the NewFields 2007 report that summarizes the results of the track ballast sampling is presented as Table 1 (Attachment 3).

Asarco collected samples of railroad ballast from property formerly owned by Union Pacific at the abandoned MR&BTRR rail line located adjacent to the Bonne Terre Tailings Site on City of Bonne Terre property in St. Francois County. In addition, a sample was obtained at a location on City of Bonne Terre property along this same rail line nearly 3,000 ft south-southwest of the tailings pile. The locations of these samples are shown on Figure 2 in Attachment 3 based on information presented on Deposition Exhibits 11 and 23. Photographs of these sample locations are contained in Deposition Exhibit 27. These samples were analyzed for total and leachable metals (TekLab, 2013a

and 2013b). The results of this sampling are presented on Table 2 (Attachment 3) which is a summary of Deposition Exhibit 24 and is based on the TekLab, Inc. analytical laboratory reports dated November 4, 2013 (Deposition Exhibits 25 and 26).

ASARCO also collected samples (SB-5 and SB-6) of soil located near the abandoned Hoffman Branch line between Leadwood and Bonne Terre. The locations of these samples are shown on Figure 3 in Attachment 3. These samples were obtained at a distance from the former rail line outside the right of way, and the rail line and track near these sampling locations were elevated on a bridge, where chat and ballast would not have been used. Therefore, SB-5 and SB6 are considered to represent control samples. Soil samples from these two locations were submitted to TekLab for analyses and the results of these analyses are summarized on Table 3 in Attachment C.

Asarco also collected samples (SB-7, SB-8 and SB-9) of railroad ballast from locations formerly owned by Union Pacific along the abandoned Missouri Pacific line (former St. Louis, Iron Mountain & Southern "Belmont Branch") located on City of Fredericktown property in Madison County. The locations of these samples are shown on Figure 4 in Attachment 3. These samples were analyzed for total and leachable metals (TekLab, 2013c and 2013d). The results of this sampling are presented on Table 4 in Attachment 3.

The results of both the NewFields and Asarco sampling of railroad ballast in St. Francois and Madison Counties detected the presence of elevated levels of cadmium, lead and zinc in the railroad ballast. Cadmium, lead and zinc have been designated hazardous substances by EPA (40 CFR § 302.4).

D. Erosion of and dissolution of trace metals from the railroad track ballast has resulted in release, or threat of release of cadmium, lead and zinc to surface water and sediment

According to EPA, chat, also known as granular mine tailings, is composed of chert-like material, containing lead, zinc and cadmium contaminants (EPA, 2012a). EPA indicates that when left exposed to the environment, the lead in chat can be a hazard to human health (EPA, 2012a). Chat particles can enter soil, surface water, groundwater, and air (EPA, 2012a). Exposure to lead has been known to cause learning disabilities and damage the human immune, blood and nervous systems (EPA, 2012a). Children are the most susceptible to these effects (EPA, 2012a). EPA (2012a) indicates that chat can be used safely when its particles are encapsulated in asphalt or concrete because the asphalt and concrete bind chat in a solid mixture so its particles are unlikely to be spread by wind or water.

The various tailing piles located within the Old Lead Belt including the Bonne Terre Mine Tailing Site, Doe Run Mine and Desloge Mine Tailing Sites (aka the Big River tailings), Elvins Mine Tailings, Federal Mine Tailings (St. Joe State Park), Leadwood Mine Tailings, and National Mine Tailings have collectively been identified by EPA as the Big River Mine Tailings/St. Joe Minerals Corp. Superfund Site (EPA, 2012b Big River Mine Tailings/St. Joe Minerals Corporation Site Description). EPA has indicated that these tailings contain residual lead contents of about one-half percent and other minerals including cadmium and zinc are present in the tailings (EPA, 2012b). EPA indicates that the State of Missouri Department of Conservation has detected elevated lead levels in fish downstream of the mining area above World Health Organization standards. EPA also indicates that dust created by wind erosion

contaminates the surrounding area and is a potential hazard to residents (EPA, 2012b). These exposures have caused elevated blood lead levels in children in the area (EPA, 2012b).

EPA indicates that the presence of elevated levels of lead, cadmium and zinc have resulted in threats or potential threats to human health and the environment, specifically:

- Surface water and various forms of biota in the Big River contain elevated concentrations of lead;
- Wind erosion and airborne dust have transported contaminants to the surrounding area and are a potential hazard to on-site workers, residents, and children;
- Fish in the Big River have shown elevated levels of lead; and
- People on-site and in the areas surrounding the mine waste piles are at risk of being exposed to contaminants in the dust and soil.

To address these risks, EPA in conjunction with the various potentially responsible parties including Doe Run Resources Corp, St. Francois County Environmental Corp., Asarco, NL Industries, the Missouri Department of Natural Resources ("MDNR") and City of Park Hill initiated a series of non-time critical response actions to address the source releases from the mine waste areas in 1995 (EPA, 2012b.) EPA also requested Doe Run and Asarco to prepare a remedial investigation/feasibility study (RI/FS) in 1997 (EPA, 2012b).

Comparison of the results of laboratory analyses of railroad ballast samples obtained by NewFields in 2006 (NewFields, 2007) and Asarco in 2013 and 2012 (Integer, 2012) to risk-based concentrations established by EPA and MDNR indicates that the presence of cadmium, lead and zinc poses a threat or potential threat to human health and

the environment. EPA regional screening values for industrial exposure to these metals are 800 milligrams per kilogram (mg/kg) for lead, 80 mg/kg for cadmium, and 31,000 mg/kg for zinc (EPA, 2013). Nearly all of the lead results and one of the cadmium results for the railroad ballast samples obtained by NewFields exceed these levels. Similarly, most of the lead results for the railroad ballast samples obtained by Asarco also exceed EPA's risk-based level for industrial uses (EPA, 2013).

These data indicate that the presence of chat in railroad ballast presents a threat or potential threat to human health. The various active and abandoned rail lines within St. Francois and Madison Counties traverse through residential, commercial and recreational areas. To ensure that human health and the environment will be protected, EPA believes that the ultimate use of chat generally should not allow people, in particular young children, to come into direct contact with any raw chat (EPA, 2007a). EPA further states that because chat contains lead, cadmium, zinc or other metal contaminants at levels that present a risk to both human health and the environment, using chat in situations that would allow people or ecological receptors (*e.g.*, animals, plants, and fish) to regularly come into contact with the material could cause sufficient risks that warrant remedial action.

EPA's regional screening values (EPA, 2013) for residential exposure to these metals are 400 mg/kg for lead, 7 mg/kg for cadmium, and 2,300 mg/kg for zinc (EPA Regional Screening Levels, May 2013). Nearly all of the lead results, most of the cadmium results, and one of the zinc results for the railroad ballast samples obtained by NewFields exceed these levels. Similarly, nearly all of the lead results and many of the cadmium results for the railroad ballast samples obtained by Asarco exceed these levels.

Therefore, the presence of chat in railroad ballast presents a threat or potential threat to human health.

EPA has established regulations specifying Criteria for Safe and Environmentally Protective Use of Granular Mine Tailings Known as "Chat" (EPA, 2007a, 2007b, 2007c, and 2012a). One of the criteria specified by EPA for chat use is for the product to be tested using the Synthetic Precipitation Leaching Procedure ("SPLP") and for the leachate from such testing to meet the National Primary Drinking Water Standards Maximum Contaminant Level ("MCL") for lead of 0.015 milligrams per liter (mg/L) and cadmium of 0.005 mg/L and the National Recommended Water Quality Criteria chronic standard for zinc of 120 micrograms per liter (ug/L) (EPA, 2007a, 2007b and 2007c).

Samples of railroad ballast in St. Francois and Madison Counties obtained by Asarco in 2013 were subjected to SPLP testing. The results of this testing indicated that three out of the four railroad ballast samples obtained from St. Francois County exceed the above listed criteria for lead and one of the samples exceeded the criteria for zinc. In addition, all three of the railroad ballast samples obtained from Madison County exceed the SPLP criteria for lead. Therefore, the chat in the railroad ballast presents a risk of leaching and dissolved phase transport of lead and zinc to surface water and consequently a threat or potential threat of release.

MDNR has indicated that Missouri does not have specific numeric criteria for metals in sediment and that likewise the EPA has not yet established federal guidelines for toxic chemicals in stream or lake sediments (MDNR, 2011 Big River, Flat River Creek and Tributary TMDL Information Sheet). In lieu of such criteria, Missouri uses the Probable Effect Levels ("PELs") suggested by McDonald, *et. al*, 2000 to evaluate the

concentrations of trace metals in sediment (MDNR, 2011). PELs are the concentrations at which some toxic effect on aquatic life is likely (MDNR, 2011). The Consensus-Based Probable Effects Concentrations ("PEC") established by McDonald are concentrations at which toxicity to benthic organisms is probable. The PELs for cadmium, lead and zinc are 4.98 mg/kg, 128 mg/kg and 459 mg/kg, respectively (McDonald, *et al.*, 2000). Comparison of the cadmium, lead and zinc levels found in the railroad ballast chat samples obtained by NewFields (listed above) indicates that most of the cadmium results, all of the lead results, and the majority of zinc results exceed the Consensus-Based PECs. Similarly, nearly all of the railroad ballast chat samples obtained by Asarco from the Bonne Terre and Fredericktown sampling locations (Figures 2 and 4) contained lead and zinc at concentrations above their respective PECs and all of the samples obtained from rail line ballast in in the Bonne Terre area (Figure 2) contained cadmium at concentrations above its PEC. In contrast, none of the results from the "control" soil samples obtained in the Leadwood area (Figure 3) contained cadmium, lead or zinc above the PELs. Therefore, chat in railroad ballast beneath active or abandoned rail lines presents a threat or potential threat of release to the environment.

MDNR has also published a Risk-Based Corrective Action Technical Guidance that contains ecological risk-based target levels for protection of aquatic life and human health from chronic and acute exposures to chemicals of concern in water including cadmium, lead and zinc (MDNR, 2006b). The target levels for chronic exposure to cadmium, lead and zinc are 0.2 ug/L, 1 ug/L, and 59 ug/L, respectively, which are equivalent to 0.0002 mg/L, 0.001 mg/L and 0.059 mg/L, respectively. Railroad ballast samples obtained by Asarco were subjected to SPLP testing to assess the leachability of

cadmium, lead and zinc from chat ballast (Tables 2 and 4 in Attachment 3). Results of this testing indicated that three of the four railroad ballast sample locations in Bonne Terre and one of the locations near Fredericktown exceeded the MDNR ecological risk-based target levels for cadmium, lead and/or zinc. None of the soil samples obtained from the Leadwood area contained detectable levels of leachable cadmium or leachable zinc at concentrations greater than the MDNR risk-based target levels although leachable levels of lead in the soil samples from the Leadwood area did exceed the MDNR risk-based levels.

A study by the U.S. Fish and Wildlife Service ("USFWS") determined that elevated residues of lead, cadmium and zinc were found in every biological form examined–algae, rooted plants, crayfish, mussels and fish (Schmitt and Finger, 1982). Furthermore, results of the USFWS survey corroborated the findings of the Missouri Department of Conservation that lead residues in edible portions of some fish from affected reaches of the Big River presently exceed recommended levels for human consumption (Schmitt and Finger, 1982). The USFWS study also found that most of the metals in surface water derived from mine tailings are transported in the solid phase, and concentrations (as well as mass) in the suspended load increase with surface water flow (Schmitt and Finger, 1982).

A study recently completed by the U.S. Geological Survey ("USGS") found that about half of the ground-feeding songbirds in the SEMO mining district contained toxic levels of lead in their blood and internal organs (USGS, 2013, and Beyer, *et al*., 2013). The results of this study indicate that chat in railroad ballast presents a potential threat of release to the environment. This study found that soil lead concentrations in SEMO were

well above those that would be considered hazardous based on ecological risk assessment guidelines. They specifically cited the cleanup levels derived in ecological risk assessments and published in EPA Records of Decision for the following sites:

1. 380 mg/kg of lead as a preliminary goal based on robins (Jacobville Neighborhood Soil Contamination Site, USEPA, Region 5, September 2009, http://www.epa.gov/region5/cleanup/jacobsville/pdfs/jacobsville_rod_200909.pdf;
2. 400 mg/kg of lead as a cleanup level based on wildlife feeding on earthworms in the Tri-State Mining District (OU3 and OU4, Cherokee County, KS, Superfund Site, USEPA, September, 29, 2006, http://www.epa.gov/superfund/sites/rods/fulltext/a2006070001149.pdf;
3. 500 mg/kg of lead as a cleanup level based on exposure of ground-feeding insectivores (OU4, Tar Creek Superfund Site, USEPA, Region 6, February 20, 2008, http://www.epa.gov/region6/6sf/oklahoma/tar_creek/ok_tar_creek_ou4_rod_200802.pdf; and
4. 605 mg/kg of lead as the recommended remedial goal based on exposure of shrews and woodcock (Raleigh Street Dump Site, USEPA, Region 4, June 2009, http://www.epa.gov/superfund/sites/rods/fulltext/r2009040003099.pdf.

The results of the NewFields and Asarco sampling of railroad chat ballast in St. Francois and Madison Counties substantially exceed all of these levels.

During my site visit, I personally observed erosion of chat ballast and embankment fill from railroad lines and bridge abutments in St. Francois and Madison Counties owned or previously abandoned by Union Pacific or its predecessors.

Photographs of some of the locations I observed are contained in Attachment 3. A 2007 photograph of the Union Pacific line near Bonne Terre shows wash outs of fill material from beneath the rail line (Conboy, 2007). Furthermore, in its 1970 Response to Questionnaire, Missouri Pacific indicated that 30 miles of the former St. Louis, Iron Mountain & Southern Belmont Branch line was constructed using tiff and rock tailing and that various embankments require restoration to permit retention of additional ballast which is needed (ICC, 1970a). Based upon findings and data documenting extensive use of mining waste by Union Pacific Railroad predecessors in Southeast Missouri, and based upon testing of that abandoned mining waste showing very high levels of lead and other metals, it is very likely that the abandoned Bismarck to Whitewater line is similarly contaminated.

Union Pacific predecessors also hauled ore, chat, and other materials from the various mines in the SEMO districts (Akers, 1938, ICC, 1972, 1970a, MSHS CP-Hill Collection, 1903-1950, and NewFields, 2007). Chat was hauled in open topped gondola rail cars (MSHS, 1912). Wrecks and derailment of chat trains occurred resulting in releases of chat to the environment (MSHS CP-Hill 1903-1950 collection).

Based upon findings and data documenting extensive use of mining waste by Union Pacific Railroad predecessors in Southeast Missouri, based upon testing of that abandoned mining waste used as ballast showing very high levels of lead and other metals, and based upon visible erosion of track ballast, embankments and bridge abutments, it is very likely that materials used to construct the existing and abandoned rail lines in the St. Francois and Madison Counties area are contaminated and causing environmental impacts in the SEMO Site.

E. The U.S. Environmental Protection Agency has used funds provided by Asarco to conduct response actions to address occurrences of cadmium, lead and zinc in surface water and sediment within St. Francois and Madison Counties.

The U.S. Department of Justice ("U.S. DOJ") filed a proof of claim in the Asarco bankruptcy case on behalf of the EPA for past and future response costs related to three SEMO sites; the Big River Mine Tailings, Federal Mine Tailings, and the Madison County Mines sites (U.S. DOJ, 2006a). EPA claimed a total of between $78 million and $88 million for past and future response costs for the SEMO sites (U.S. DOJ, 2006a). The U.S. DOJ also filed a Proof of Claim on behalf of the U.S. Department of Interior ("DOI") and U.S. Department of Agriculture ("USDA") for natural resource damage claims for an estimated amount of nearly $338 million (U.S. DOJ, 2006b.) MDNR submitted a Proof of Claim for the state's share of future response costs and for operations and maintenance costs of over $10 million (MDNR, 2006c). MDNR also submitted a Proof of Claim for natural resource damages of $506 million (MDNR, 2006d).

The U.S. Bankruptcy Court for the Southern District of Texas Corpus Christi Division issued a settlement agreement March 2008 regarding the various claims relative to the SEMO Sites. Pursuant to this Settlement Agreement, EPA was allowed a general, unsecured claim in the total amount of $37,500,000 for all EPA and MDNR response action cost claims for the three SEMO sites. The DOI was allowed a general unsecured claim for past costs of $233,000 and a general unsecured claim of $29,767,000 for DOI/USDA and MDNR natural resource damage assessment costs for the three SEMO sites. MDNR was allowed a general unsecured claim for past natural resource damage assessment costs and future oversight and/or maintenance response costs in the total

amount of $1,250,000. In addition, the DOE RUN Resources Company was allowed a general unsecured claim in the amount of $759,327.80 in connection with any and all past or future response costs or natural resource damages related to three SEMO sites.

As a result of the Asarco bankruptcy settlement, EPA established special accounts to pay for past and future cleanup costs incurred by federal and state agencies at more than 80 Superfund sites contaminated by mining operations in Missouri and 18 other states (EPA, 2011a). Pursuant to the Asarco Bankruptcy settlement, EPA distributed the funds to clean up the various Superfund sites including the Big Rive Mine Tailings/St. Joe Minerals, Federal Mine Tailings, and Madison County Mines Project sites in SEMO (EPA, 2012b). EPA set aside a total of $44 million for cleanup of the SEMO sites (EPA, 2012b). I understand EPA is utilizing these funds in compliance with the NCP. EPA has indicated that nearly all of the costs for cleanup of these sites will be covered by funds from the special account established in 2009 as part of the $1.79 billion Asarco bankruptcy settlement (EPA, 2011a).

V. EXHIBITS SUPPORTING OPINIONS

Exhibits supporting or summarizing my opinions are included in Attachment 3. These exhibits are preliminary as I may change the format of the exhibits and/or add to or update the information depicted on the above exhibits. I may also develop additional exhibits based on information drawn from the materials and documents considered in forming my opinions (Attachment 2) and to better illustrate the data and information shown on the exhibits contained in Attachment 3. I may also obtain additional photographs of the railroad ballast, railroad embankments or other features. I may also

use additional demonstrative exhibits at trial.

VI. COMPENSATION

I am being compensated at the rate of $200/hour for my work evaluating the various documents and data in this matter, preparing this expert report, preparing for deposition and other activities and at rate of $100/hour for travel time plus expenses at cost plus 10%. I am to be compensated at the rate of $400 per hour for my time spent testifying in a deposition or during the trial in this matter.

VII. OTHER TESTIMONY

The other cases in which I have provided expert testimony during deposition or at trial within the past four years are as follows:

Name of Case	Court	Trial or Deposition Testimony
Burley, et al. v. BNSF	U.S. District Court, District of Montana, Billings Division Cause No. CV-07-147-BLG-RFC-CSO; CV-08-30-BLG-RFC-CSO; and CV-07-148-BLG-RFC-CSO	Deposition
Intalco Aluminum Corporation, v. CNI et al.	Superior Court of Washington for Whatcom County, Case No. 06 2 01842 3	Deposition
Michael E. Anderson, et al. v. BNSF Railway Company, et al.	Montana First Judicial Circuit Court, Lewis and Clark County, Case No. ADV-2008-101	Deposition
The Board of County Commissioners of the County of La Plata, Co. v. Brown Group Retail, Inc. et al.	U.S. District Court for the District of Colorado, Case No. 08-CV-0085-LTB-KMT	Deposition and Trial
City of Livingston, et al. v. BNSF Railway Company, et al.	Montana Sixth Judicial District Court, Park County, DV-07-141	Deposition

Attachment 1

Curriculum Vitae of Paul V. Rosasco

PAUL V. ROSASCO, P.E.

Engineering Management Support, Inc.
7220 West Jefferson Avenue, Suite 406
Lakewood, CO 80235

(303) 940-3426

paulrosasco@emsidenver.com

Mr. Rosasco has over 33 years experience in providing supervision, management, and technical review for geological, hydrogeological, and engineering projects. He has designed and implemented geological, hydrogeological and geophysical investigations and environmental monitoring programs for sites ranging from 0.5 acres to over 300 square miles. Mr. Rosasco has extensive project management and technical experience in a wide variety of waste disposal and environmental contamination projects. He has provided design, site engineering, and construction management services and acted as owner's representative for surface and subsurface remediation projects. He has also been involved in a variety of geotechnical, geologic hazard, and water supply evaluation projects.

Mr. Rosasco has 30 years of experience with all aspects of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and National Priorities List (NPL) site projects where he has worked at over 40 Superfund Sites. His experience includes evaluation of existing data and development of scopes of work, negotiation of scopes of work, administrative orders and consent decrees, implementation and supervision of remedial investigations, feasibility studies, remedial designs, remedial actions, removal actions and performance and effectiveness evaluations of operation and maintenance of removal and remedial actions.

Mr. Rosasco also has 30 years of experience with Resource Conservation and Recovery Act (RCRA) facilities where he has performed characterizations of generator, treatment, storage, disposal sites, assessed the nature and extent of contamination, and evaluated and designed corrective measures. He has participated in the development and review of RCRA Part B applications, ground-water monitoring and corrective measure programs and closure plans. Mr. Rosasco has also developed operations plans and designed and facilitated permitting for solid and liquid waste disposal sites.

Mr. Rosasco has provided expert testimony related to groundwater occurrence, flow and chemical transport, the nature, extent and sources of environmental contamination, the necessity and appropriateness of various remedial actions, consistency of response actions with the National Contingency Plan (NCP) and

other environmental regulations, and allocation of response costs. He has been qualified by several federal courts as an expert in the areas of hydrogeology, contaminant occurrence, fate and transport, remedial actions, cost allocation and National Contingency Plan (NCP) consistency. He has also provided expert testimony on the role of environmental issues and site remediation related to property valuation and condemnation proceedings. He has testified at numerous regulatory hearings and public meetings on issues ranging from site selection and the design and operations of waste disposal facilities, environmental contamination and remediation, and water quality standards. He has had his deposition taken thirty-seven times, testified at trial thirteen times and at formal administrative or agency hearings seven times. He has also provided expert assistance related to construction claims and disputes. A listing of matters at which he has provided expert testimony is included as Attachment A.

In addition to expert testimony, Mr. Rosasco has provided expert assistance in support of litigation in a wide variety matters including hydrogeological characterization, nature, extent and causation of contamination, and remedial actions at regional groundwater contamination sites such as the San Gabriel Valley – Baldwin Park Operable Unit, the Suburban Operable Unit and the former Fairchild Industries facility in southern California; the former Lockheed facility in Redlands, CA; regional mining districts including Leadville, CO, Bunker Hill, ID, Crede, CO, and Jamestown CA; petroleum refineries, bulk plants, and retail outlets; and various manufacturing and commercial facilities throughout the country. Mr. Rosasco served as an independent arbiter during settlement negotiations for a leaking underground storage tank site in Colorado and served as the 30-B6 representative relative to the claimed releases from adits, tunnels and portals in the upper portion of the Coeur d'Alene Basin.

EDUCATION

M.E., Engineering Geology, Colorado School of Mines, 1985

B.S., Geology, University of Oregon, 1976

REGISTRATIONS

Professional Engineer – Colorado
Professional Engineer – Washington
Professional Engineer – Illinois (retired status)

EMPLOYMENT HISTORY

1994 – Present Engineering Management Support Inc.
President
Principal Engineer

1985 - 1994 Harding Lawson Associates
Member of Board of Directors
Senior Vice President
Director of Program Development
Consulting Vice President
Director of RCRA and CERCLA Services
Northeast Regional Manager
Mid-continent Operating Officer
Rocky Mountain Regional Manager
Principal in Charge - Denver Office
Associate in Charge - Denver Office

1981 - 1985: Fox Consultants, Inc.
Hydrogeology group manager
Project geological engineer and Rock mechanics supervisor

1979 - 1981: Department of Energy/Office of Nuclear Waste Isolation, Colorado School of Mines
Project geologist and Assistant project manager

1978 - 1979: Colorado School of Mines
Research assistant

1977 - 1978: Kennicott Copper Co./Bear Creek Mining Co.
Assistant geologist

1976 - 1977 Lane County Community College
Mathematics Instructor

COMMUNITY SERVICE

Former Member - Jefferson County, Colorado Planning Commission (member and former Chairman [twice] and Vice-Chairman [twice] 1994 - 2004)

MEMBERSHIPS

Association of Groundwater Scientist and Engineers

PUBLICATIONS

1995 Weaver, Jeffrey, D., Digel, Robert, K., and Rosasco, Paul V., Performance of a Post-audit of Groundwater Flow Models Used in Design of a Groundwater Capture/Containment System, in Symposium on Subsurface Fluid Flow (Ground-Water) Model, American Society for Testing and Materials.

1985 Rosasco, Paul, V., Geometric Continuity of Structural Discontinuities, CSM-ONWI Test Site, Idaho Springs, Colorado. Masters of Engineering report, Colorado School of Mines, Golden, Colorado.

1984 Rosasco, Paul, V. and Curry, John, A Cooperative Agreement to Investigate and Remedy Chemical Contamination at the Boulder/Marshall Landfills, Colorado. Prepared for the 5th National Conference on Management of Uncontrolled Hazardous Waste Sites.

1981 Mining Technology Development in Crystalline Rock. "Advances in the Science and Technology of the Management of High Level Nuclear Waste," U.S. Department of Energy.

1980 Mining technology development for hard rock excavation. "Rockstore."

ATTACHMENTS

A. Selected Mining and Trace Metal/Radionuclide Project Experience
B. Selected Experience with Cost Allocation and Recovery

Selected Mining and Trace Metal/Radionuclide Project Experience
Paul V. Rosasco, P.E.

1. **Burlington Northern & Santa Fe, Railway Co. Railyard, Helena Montana**

   Mr. Rosasco reviewed documents and offered opinions in an expert report and at deposition regarding historic operations at the railyard that resulted in lead contamination in surface soil and diesel contamination in groundwater at and offsite of the railyard. Mr. Rosasco evaluated the need for remedial action to address this contamination and the costs associated with such actions. Mr. Rosasco evaluated the actions proposed by Plaintiffs' expert and determined that they were unnecessary, disruptive to the community and grossly over-expensive. Mr. Rosasco identified other, less costly approaches to address the remaining very low levels of lead occurrences in soil on the Plaintiffs' properties..

2. **Midnite Mine National Priorities List (NPL) Site, Spokane, Washington**

   Mr. Rosasco evaluated the overall scope, costs and necessity of additional investigations performed by EPA relative to a Remedial Investigation/Feasibility Study at the former Midnite Mine uranium mine near Spokane. Mr. Rosasco reviewed work performed pursuant to the RI/.FS relative to the data quality objectives identified by EPA in the various work plans, quality assurance project plan (QAPP) and related addenda. Mr. Rosasco identified work that was unnecessary to meet the purpose and objectives of the RI/FS and the data quality objectives identified in the QAPP and related addenda. Mr. Rosasco also evaluated the work performed by EPA relative to work previously conducted by the mining companies and opined that much of the work conducted by EPA was duplicative to investigations previously conducted at the site and was not needed to assess potential risks posed by the site or to selected remedial actions for the site. Mr. Rosasco detailed specific items that he considered to be unnecessary and identified the actual or estimated unnecessary costs associated with such items. Mr. Rosasco testified during two depositions and provided written testimony at the trial in this matter.

3. **Intalco Aluminum Corporation, Ferndale, Washington**

   Mr. Rosasco performed evaluations, prepared expert reports, and offered opinions during a deposition relative to the nature of releases of toxic substances and resultant contamination, the consistency of prior corrective actions with the Washington Model Toxics Control Act (MTCA), and the costs incurred by the Intalco Aluminum Corporation at its Ferndale facility. Mr. Rosasco identified and evaluated the necessary costs incurred to investigate and remediate past releases or threat of releases of hazardous substances including valuation of air space in onsite permitted hazardous and industrial waste landfills utilized as part of the remedial actions taken at the site.

4. **Former Abound Solar Facility, Longmont, Colorado**

   Mr. Rosasco assessed and inventoried cadmium bearing hazardous wastes and other solid wastes and contaminated wastewaters that were abandoned or threatened to be abandoned as a result of Abound Solar's bankruptcy filing. Mr. Rosasco performed sampling of the interior and exterior areas of the facility to assess potential releases of hazardous materials to floor and dock drains and sediment and soil at the facility. Mr. Rosasco prepared an expert report documenting the presence of hazardous wastes at the facility, violations of hazardous waste management laws and regulations, and the estimated costs to remove the hazardous wastes from the facility.

5. **Talache Mine Tailings Site, Atlanta Mining District, Idaho**

   Mr. Rosasco reviewed information related to site conditions, ownership and operation, causation factors and remediation requirements associated with the 1996 failure of the Talache Mine Tailings pile. Mr. Rosasco provided expert testimony regarding potential cost allocation between the various parties including both past and current owners and operators and the factors affecting the equity of various allocation methods developed by him and by other experts.

6. West Lake Landfill – OU-1, Remedial Design/Remedial Action, Bridgeton, Missouri

Mr. Rosasco is the project manager and lead technical consultant for the remedial design/remedial action to address the presence of radiologically-impacted materials within a former solid waste landfill. Remedial actions selected by EPA include design and installation of a new engineered landfill cap that includes components necessary to address gamma radiation, radon emissions and requirements of the Uranium Mill Tailings Radiation Control Act, armoring of the landfill toe to protect against possible flooding by the Missouri River, consolidation of contaminated soil from adjacent properties and disposal on-site, development and implementation of institutional controls, and development and implementation of long-term groundwater and landfill/radon gas monitoring and site surveillance. Mr. Rosasco supervised a multi-disciplinary technical team composed of five different consulting firms to develop a conceptual remedial design and prepare remedial design planning documents. Mr. Rosasco subsequently supervised preparation of a Supplemental Feasibility Study (SFS) requested by EPA to evaluate possible excavation and on-site and offsite disposal alternatives. The SFS included development of conceptual designs for excavation of overburden waste and soil cover along with solid wastes containing radiologically-impacted materials; design of a possible new engineered onsite disposal cell; evaluation of potential offsite disposal facilities; evaluation of potential impacts to workers and the public including potential traffic and rail accidents, greenhouse gas emissions, potential impacts associated with bird hazards to nearby Lambert-St. Louis International Airport, and worker accidents and exposures; and detailed evaluation of expected costs and schedules for various alternatives for site excavation, offsite or onsite disposal and site restoration. Mr. Rosasco currently is supervising additional activities including a comprehensive groundwater monitoring program, installation of additional fencing and site controls, and various other additional evaluations requested by EPA including evaluations of alternative excavation volumes, alternative landfill cover designs, alternative treatment technologies, and fate and transport modeling of radionuclides.

7. West Lake Landfill – OU-1, Remedial Investigation/Feasibility Study, Bridgeton, Missouri

Mr. Rosasco was project manager and lead technical consultant for the Remedial Investigation/Baseline Risk Assessment/Feasibility Study (RI/BRA/FS) of this NPL Site pursuant to a CERCLA Administrative Order on Consent from EPA Region VII. The Site is a municipal solid waste landfill that contains elevated levels of uranium, radium, thorium and their related decay products resulting in part from use of soil mixed with barium-sulfate waste from uranium recovery operations in conjunction with the Manhattan Project. Mr. Rosasco supervised various field investigations including overland gamma surveys, surface and subsurface soil sampling and analysis, monitoring well construction and sampling, storm water runoff and sediment sampling, and radon flux measurements (large area carbon canisters) and developed supplemental scopes of work for follow-up investigations necessary to complete the RI, BRA and FS. He has been responsible for preparation of various technical reports including work plans, data reports, evaluation of treatability study requirements, and the Remedial Investigation, and Feasibility Study. Mr. Rosasco also supervised preparation of the Baseline Risk Assessment.

8. Groundwater Monitoring Program – Tailing Impoundments, Cotter Canon City Mill

Mr. Rosasco designed a long-term groundwater monitoring program to identify possible leakage from tailings impoundments at this uranium/vanadium mill site. Mr, Rosasco developed the overall approach to development of the groundwater monitoring plan, presented the approach to the State regulatory agency and achieved concurrence from the State on the approach. Mr. Rosasco designed the site characterization program and assisted Cotter with implementation and evaluation of the resultant data including geophysical (resistivity) investigation, soil boring and sampling and monitoring wells installation. Mr. Rosasco evaluated the results of the site characterization effort and prepared technical summaries for submission to the State. At the conclusion of the site characterization effort, Mr. Rosasco prepared a groundwater monitoring plan that presented the overall conceptual model of subsurface conditions beneath the impoundments, the proposed groundwater monitoring network, analyte list and sampling frequency and the data evaluation procedures including statistical evaluations of temporary trends in water quality results.

9. Old Pond Area - Cotter Corporation Mill Site, Canon City, Colorado

Mr. Rosasco prepared a CERCLA feasibility study to evaluate remedial alternatives to address residual soil contamination remaining beneath former tailing ponds at this uranium mill site. Mr. Rosasco's work involved evaluation of the historic soil sampling data relative to potential impacts to groundwater and determination of the extent and volume of soil to be addressed by the remediation activities. Mr, Rosasco developed and evaluated of engineering alternatives including for example capping, in situ flushing or stabilization, partial soil removal, or complete soil removal. Mr. Rosasco prepared an NCP style feasibility study report to present the alternatives assessment and address requirements associated with a previously approved Remedial Action Plan and pending uranium mill license renewal. Mr. Rosasco presented briefings of the results of these evaluations at public meetings and at mediation hearings.

10. Denver Radium NPL Site – Operable Unit VIII, Denver, Colorado

Mr. Rosasco provided independent technical review of the remedial design for excavation of soils containing radium and uranium, onsite solidification and stabilization using flyash and cement, placement and compaction of the stabilized material into a monolith and subsequent construction of a multiplayer layer cap over the constructed monolith. Mr. Rosasco subsequently served as the owner's engineer and site representative during the construction activities and acted as technical liaison with the various contractors and regulatory agencies. Mr. Rosasco and other members of his firm developed methods to address unexpected conditions that arose during construction including dust emissions from the processing equipment and kerosene impacted soil from historic rhenium recovery operations to prevent or reduce the size of possible claims for changed conditions and to address regulatory agency concerns. Mr. Rosasco was also responsible for the implementation and evaluation of the onsite and offsite groundwater monitoring, operations and maintenance inspections and reporting, and the long-term maintenance activities at the Site.

Mr. Rosasco also provided technical representation at technical meetings with EPA Region VIII, the Colorado Department of Public Health and Environment, City and County of Denver and local citizens. He provided client representation and technical input to the scoping and review of evaluations being performed by a Peer Review Panel and the Five Year Review. Mr. Rosasco also provided technical assistance and representation during the facilitated dialogue process initiated by EPA Headquarters to resolve citizen and Denver's concerns regarding the protectiveness of the remedy. Mr. Rosasco prepared comments and supervised the overall preparation of comments on EPA's Five Year Review Report. Mr. Rosasco also assisted counsel in development and negotiation of cash-out settlement for his client.

11. Bartlesville Zinc Refinery and Bartlesville National Priorities List Site, Oklahoma

Mr. Rosasco provided expert analysis and expert testimony related to cost recovery and allocation of response costs related to the investigations and clean-up of on-site (RCRA) and off-site (CERCLA) releases of lead, cadmium and arsenic resulting from 85 years of operations at a zinc refinery. Project work included evaluation of past response costs, evaluation of the necessity and consistency with the National Contingency Plan of the costs associated with past and ongoing response actions, and development and implementation of methodologies for the allocation of both on-site response costs incurred under RCRA and the CWA and off-site response costs incurred under CERCLA. Mr. Rosasco also provided expert testimony both in deposition and at trial.

12. Denver Radium Site, Operable Unit III, Denver, Colorado

Mr. Rosasco assisted a prospective purchaser of a portion of Operable Unit III of the Denver Radium Superfund Site. Mr. Rosasco prepared the Materials Management Plan, negotiated soil clean-up levels for radium with the State, and provides technical direction for removal, sampling and disposal of radium soils from utility excavations and new construction. Mr. Rosasco also conducts groundwater and indoor air sampling (radon and volatile organic compounds) as part of ongoing work to assist his client in maintaining bona fide prospective purchaser status.

13. California Gulch National Priorities List (NPL) Site, Leadville, Colorado

Mr. Rosasco provided technical assistance to the Lake County Commissioners in conjunction with EPA and private party investigations, evaluations and remediation associated with the California Gulch "Superfund" site. His involvement included evaluations of remedial alternatives for various mine wastes and development of alternative remedial strategies and evaluation of potential risks posed to children by lead in soil and ground water and evaluation of risks posed by other trace metals in soil and ground water. These evaluations included identification and analysis of potential sources of lead, cadmium, zinc and arsenic contamination of surface water, ground water, soil and sediment and the evaluation of various remedial actions related to source control. At the request of the County, he evaluated numerous mine waste piles and waste rock piles located in a major drainage basin above Leadville and developed alternative remedial designs to reduce the suspended and dissolved metals loading to surface water and ground water and still preserve those piles with historic, cultural, visual or tourist-related significance and value. He also participated in the development of EPA's risk assessments for residential, commercial and recreational properties in the Leadville area. As a result of his evaluation of the correlation between measured blood lead levels and the concentrations of lead in residential yard soils, EPA selected a remediation level of 3,500 ppm for lead in residential soils rather than a 1200 ppm level based on the results of the Integrated Risk, Uptake, Biokinetic (IEUBK) model evaluations. He also participated in the development of alternative remedial strategies for residential soils resulting in implementation of more beneficial measures such as household dust removal, lead paint remediation, and education as an alternative to and prior to any soil excavation and removal.

14. Arsenic Contaminated Soil and Groundwater, Commerce and Ridgeway, Texas

As an expert witness, Mr. Rosasco evaluated occurrences of arsenic in surface soils, surface water and sediment resulting or reportedly resulting from rail transport of arsenic trioxide and subsequent use in manufacturer of various pesticides and herbicides. Evaluations conducted by Mr. Rosasco or under his supervision included development of a database and geographical information system of the thousands of results of various sampling events conducted by various parties, evaluation of historic uses of arsenic in the area including pesticide manufacturer, cotton burr burners, and use for weed control along highways, streets and individual residential lots. Mr. Rosasco evaluated background levels and various cleanup and health-based criteria for arsenic. Mr. Rosasco also evaluated occurrences of arsenic in sediment within the Ridgeway community water system and provided expert opinions regarding the nature and source of reported arsenic occurrences in the community water system.

15. Olympic View Landfill, Port Orchard, Washington

Mr. Rosasco currently provides senior technical review and project coordination for Waste Management Inc. related to completion of a Remedial Investigation and Feasibility Study (RI/FS) of the Olympic View Sanitary Landfill being conducted pursuant to Washington solid waste regulations and Model Toxics Control Act. Mr. Rosasco provides technical direction to various consultants, reviews consultant scopes of work, cost estimates and deliverables, coordinates and manages meetings with regulatory agencies and assists Waste Management with evaluation and implementation of operations and maintenance requirements at the landfill.

16. Weyerhauser Pulp and Paper Mill, Longview, Washington

Mr. Rosasco provided quality control and senior technical review in conjunction with the evaluation and demolition of a chlor-alkalai plant at this pulp and paper mill. During demolition of the chlorine plant, extensive mercury contamination, resulting from losses during operation of the plant, were discovered in the subbasement and underlying soils. Various investigation plans were developed and reviewed to insure that all of the mercury contamination was identified and addressed as part of the demolition activities without significant delay in the demolition and construction schedules.

17. Tulalip Landfill, Snohomish County, Washington

Mr. Rosasco provided senior technical review and project coordination for a group of companies including Waste Management Inc., Monsanto Corporation and the Port of Seattle related to the Remedial Investigation and Feasibility Study (RI/FS) of the Tulalip Landfill. The Tulalip Landfill is a closed landfill located on Tulalip Tribal land in the estuary of the Snohomish River. The landfill was the source of numerous leachate seeps containing lead, cadmium, nickel, mercury, and other trace metals into the estuary potentially affecting freshwater and marine aquatic life. In addition, the Indian tribe, the nearby City of Marysville and numerous private residences relied on ground water for water supply. Numerous terrestrial species including eagles and other raptors, deer and fox were present at the landfill. Mr. Rosasco's work included ground-water modeling to evaluate the potential impact of site metals in ground water on the current water users and in conjunction with projected increased pumping rates anticipated in the future. His work also entailed evaluation of on-site soil, sediment, leachate seep, surface water and ground water and the potential impact such contamination posed to the surrounding estuaries and aquatic ecosystems. He also provided engineering services in conjunction with the technical and cost evaluations of various alternative landfill capping alternatives and leachate and ground water collection and treatment alternatives. During the course of his involvement with this project, he provided project management and project coordination services for the various companies including coordination of the various different consultants involved with the geotechnical and environmental investigations, risk assessment and feasibility studies, coordination between the various consultants and the companies and between the companies and the EPA and the Tulalip Tribe. He also prepared and made numerous technical presentations at various public, agency and legal meetings on behalf of the involved companies.

Subsequent to the completion of the RI/FS, Mr. Rosasco was retained to assist the remedial design/remedial construction team with evaluations of alternatives to extensive soil import requirements. The principal alternative considered was excavation and regrading of refuse from below the water table as an alternative to achieving grades through costly import of offsite borrow soil. The primary issue associated with the refuse regarding alternative was the handling and disposition of large volumes of leachate containing trace metals. Alternatives evaluated included discharge to the nearby sloughs under an NPDES equivalent construction water discharge permit, limited treatment onsite prior to discharge, primary and secondary treatment onsite and offsite disposal. Alternative methods for collecting the leachate including dewatering prior to construction with well points or trenches and dewatering of excavations during construction were also considered. Monitoring programs were developed for all of the onsite discharge alternatives. Results of the various evaluations were presented in technical briefings to representatives of the Tulalip Tribe, EPA Region X and their consultants.

18. Milltown Reservoir NPL Site, Missoula, Montana

Mr. Rosasco was responsible for the development and preparation of the draft Feasibility Study for this Superfund Site that included reservoir sediments contaminated with heavy metals including arsenic, copper, and lead and associated arsenic and heavy metal contamination of ground water and water wells in and around Milltown, Montana. The source of the contamination was reservoir sediments that had accumulated behind the Milltown dam as a result of historic mining and mine waste disposal practices in the Clark Fork River drainage basin. This work entailed investigation of the reservoir sediments using a flat-bottomed boat and a portable drill rig and drive sampling equipment specifically developed by me for this project. The field investigations also included monitor well drilling, installation, development and sampling, and aquifer testing. The work also included geochemical evaluations including evaluation of reduction-oxidation potential (redox) and metals speciation. Remedial alternatives evaluated include various dredging and other sediment removal techniques, operational controls and restrictions for the dam and power plant operations, and provision of alternative water supplies.

19. Colorado School of Mines Research Institute, Golden, Colorado

Mr. Rosasco provided independent technical review of the remedial design and remedial action for excavation of soils containing radium and uranium. His work pertained to a dispute between the owner and the contractor regarding the overall cost of the action, the volume of soil that had been and remained to be excavated, and provisions associated with the lump sum contract for this work. Mr. Rosasco evaluated the site investigation and design data, conducted a site inspection, met with project staff and discussed the extent of the excavation activities to date, remaining soil to be excavated and changed conditions encountered during performance of the remedial action. Mr. Rosasco provided an independent assessment of the site data relative to the estimated volume of soil to be excavated presented in the design documents, the basis for the change conditions, and the accuracy of the soil volumetric data.

20. Proposed Low-Level Radioactive Waste, Western Colorado

Mr. Rosasco was project manager and project geologist/hydrogeologist for a site-selection and site characterization studies for a proposed low-level radioactive waste/uranium mill tailings disposal site proposed for western Colorado. Mr. Rosasco performed regional investigations and evaluations of over a dozen potentially suitable sites located in the western slope of Colorado and develop investigative plans and implanted geologic/hydrogeologic/geotechnical investigations of the clients preferred site pursuant to the requirements set forth in 10 CFR 60 and equivalent state regulations related to low-level radioactive waste disposal sites. Mr. Rosasco prepared various technical reports and presented the results of these evaluations to the radiation control division of the state health department and at public meetings.

21. DOE-Office of Nuclear Waste Isolation, Crystalline Repository Program

Mr. Rosasco served as project geologist and assistance project manager for various technical investigations related to potential development of a high-level radioactive waste disposal repository in crystalline (igneous and metamorphic) rock terrains. Mr. Rosasco performed underground mapping and characterization of rock joints, natural and blast-induced fractures and other geologic discontinuities including development of techniques for and subsequent mapping of horizontal and vertical rock exposures in various tunnels, drifts and audits in the vicinity of an underground test facility in Colorado. Mr. Rosasco prepared an electronic database of the accumulated results and developed and evaluated various statistical and predictive models of the fractures and discontinuities and their characteristics. Mr. Rosasco also participated in evaluations of controlled blasting techniques and fracture permeability studies as well as serving as assistant project manager.

SELECTED EXPERIENCE WITH COST ALLOCATION AND RECOVERY

1. Midnite Mine, Spokane, Washington

   Mr. Rosasco evaluated the data quality objectives (DQO) and the data obtained by the mining companies pursuant to an Interim Agreement and Reclamation Plan with the Bureau of Land Management relative to data obtained by EPA pursuant to a Remedial Investigation/Feasibility Study. Mr. Rosasco identified data obtained by EPA that were redundant with the results obtained by the mining company investigations, were not needed to evaluate potential risks posed by the Site or to select a remedy, or that were otherwise not supported or documented by the DQO process and therefore inconsistent with the NCP. Mr. Rosasco evaluated the $7.65 million in costs incurred by EPA to complete the RI/FS and developed a method for assigning the costs to the various RI/FS activities and identified pro rata costs on a per sample basis. Based on his analysis, Mr. Rosasco opined that $1.8 million of the costs were associated with duplicative or otherwise unnecessary sampling conducted by EPA. Mr. Rosasco provided testimony during deposition and written trial testimony.

2. Suburban Operable Unit, San Gabriel Valley Superfund Site,

   Mr. Rosasco provided expert assistance for mediation between U.S. EPA and a potentially responsible party relative to recovery of past cost claims asserted by EPA. Mr. Rosasco reviewed the available site information, regional groundwater quality information and site-specific soil gas results relative to potential contributions of historic operations at the site and the overall regional groundwater contamination. Mr. Rosasco evaluated volatile organic compound concentrations in groundwater attributable to regional and upgradient sources using chemical equilibrium calculations and compared those to the measured soil gas levels to demonstrate that the observed soil gas readings could be explained by the regional and upgradient groundwater contamination and were necessarily indicative of impacts from historic operations at the site in question. Mr. Rosasco presented his evaluations to the independent mediator and assisted in the mediation of this matter.

3. La Plata County Detention Center, Durango, Colorado

   Mr. Rosasco supervised investigations indoor air quality, soil, soil gas and groundwater contamination at and downgradient of the site, evaluated potential sources of contamination, and assessed potential remedial alternatives for a former manufacturing facility contaminated with chlorinated solvents and 1,4-dioxane that is the current site of a county detention center. Mr. Rosasco testified in both deposition and at trial regarding the need for the various investigations and proposed remedial actions, the costs incurred and the consistency of the actions and costs with the NCP. Mr. Rosasco continues to assist La Plata County with ongoing evaluations and remedial action planning.

4. Tosco Refinery, Martinez, California

   Mr. Rosasco provided expert assistance and expert testimony regarding claims of fraud, breach of contract claims and counterclaims, allegations of illegal disposal of hazardous wastes by the current and past owners and operators, and general environmental conditions at this nearly 80 year old petroleum refinery. Mr. Rosasco evaluated data and regulatory compliance issues associated with various RCRA Regulated Units, Solid Waste Management Units, aboveground storage tanks, and process units at the refinery and associated off-site facilities. Mr. Rosasco offer opinions during expert deposition regarding the identification and classification of commercial products, solid wastes and hazardous wastes at the refinery. Mr. Rosasco also opined regarding the dates and nature of known releases of petroleum products and wastes relative to the dates of implementation of various provisions of the hazardous waste regulations.

5. Baldwin Park Operable Unit of the San Gabriel Valley Superfund Site, California

   Mr. Rosasco developed a numerical allocation model for use in settlement negotiations between the numerous parties involved in this large regional ground-water contamination problem. The allocation model was based on the site database developed by the parties and incorporated environmental monitoring results from various media, information on historic operations and other factors in producing a technically and numerically based allocation of the anticipated 40 to 100 million dollar remedy for regional ground-water contamination. The model was used to develop a "best" allocation method and to test the sensitivity of the results to various factors and to evaluate allocation methods developed by other parties. Project work also included evaluation of the various site factors contributing to the contamination and evaluation of alternative models developed by other parties. Presentation of the model results to the other involved parties at settlement meetings was also part of the project work.

6. Mystery Bridge Road NPL Site ("Brookhurst Subdivision), Evansville, Wyoming

   Mr. Rosasco conducted evaluations of the various activities performed by the parties involved with the CERCLA RI/FS of the chlorinated solvent and hydrocarbon contamination beneath the subdivision. Mr. Rosasco also evaluated the sources and extent of the chlorinated solvent and hydrocarbon contamination associated with the industrial properties located to the south of the subdivision. Mr. Rosasco also evaluated the RCRA RFI/CMS activities being conducted for the hydrocarbon contamination associated with the refinery and other facilities located to the west of the subdivision. These evaluations included assessment of the nature and extent of the contamination within the subdivision and associated with each of the industrial properties. His work included evaluation of the fate and transport of chlorinated solvents and aromatic hydrocarbons within soil, soil gas, groundwater and free product along with evaluations of the design, design criteria and purpose and effectiveness of various interim remedial measures. Mr. Rosasco also reviewed various EPA documents regarding the need for not only these investigations but

also for the removal action conducted in 1987 that resulted in installation of the public water supply system as an alternative to use of individual wells within the subdivision. Based upon his evaluations Mr. Rosasco developed a series of spreadsheets and associated graphics depicting twelve different allocation schemes that all resulted in very similar ranges of costs being allocated to the chlorinated solvents plumes/industrial facilities compared to the hydrocarbon plume/refinery. As part of his work Mr. Rosasco also evaluated all of the costs that EPA had recovered from the various industrial companies, the costs incurred by the various industrial companies and the refinery associated with the RI/FS, RFI/CMS or the various interim actions each had performed. Mr. Rosasco evaluated the costs being sought by the industrial companies and the associated activities in terms of their compliance with the National Contingency Plan (NCP). Mr. Rosasco also evaluated the various activities and costs being sought by the refinery as part of the RFI/CMS in terms of their compliance with the NCP.

7. Barter Battery Recycling Site, Denver Colorado

Mr. Rosasco provided expert analysis and expert testimony regarding the consistency of various investigative and remedial actions associated with soil remediation for lead and poly-chlorinated biphenyl contamination with the requirements of the National Contingency Plan (NCP) and the overall necessity and reasonableness of these activities and the resultant costs. Mr. Rosasco also develop an allocation of the respective costs associated with the lead and PCB contamination and remediation activities. Based in part on his evaluations, the Court ruled that the work performed and the associated costs had not been incurred in a manner consistent with the NCP and the case was dismissed on summary judgment.

8. Big Muddy Oil Processing / Powder River Crude Processing Facility, Glenrock, WY.

Mr. Rosasco provided expert assistance during settlement negotiations and in preparation for trial in several cases related to cost recovery under RCRA and allocation of costs between (1) various oil companies that used or sold product to this facility, (2) between the operator of this crude oil processing facility and the oil companies which sold or sent oil to this facility for recovery or processing, (3) between a refinery and the transporter who hauled tank heels to the facility, and (4) between the operator/ oil companies and the operators insurance carriers. Project work included development of various allocation methodologies based on volumetric contributions, the nature and composition of materials sent to the facility, the history of operations at the facility, and the degree of control and degree of care exercised by the oil companies, transporters and operators. Mr. Rosasco also performed site inspections and inspections during remediation, prepared various expert reports, and participated in and made technical presentations during court supervised settlement negotiations.

9. Bartlesville Zinc Refinery and Bartlesville National Priorities List Site, Oklahoma

   Mr. Rosasco provided expert analysis and expert testimony related to cost recovery and allocation of response costs related to the investigations and clean-up of on-site (RCRA) and off-site (CERCLA) releases of lead, cadmium and arsenic resulting from 85 years of operations at a zinc refinery. Project work included evaluation of past response costs, evaluation of the necessity and consistency with the National Contingency Plan of the costs associated with past and ongoing response actions, and development and implementation of methodologies for the allocation of both on-site response costs incurred under RCRA and the CWA and off-site response costs incurred under CERCLA. Mr. Rosasco also provided expert testimony (both in deposition and at trial) and expert assistance including assistance in the questioning of opposing experts.

10. Fisher-Calo National Priorities List Site, Kingsbury, Indiana

    Mr. Rosasco performed an evaluation of the "divisibility of harm" related to paint manufacturing wastes which had been sent to the solvent recycling operations at this site. His project work included a site inspection, review of historical and RI/FS documents, review of historical aerial photographs, and an evaluation of site conditions, the nature and extent of contamination, and the EPA selected remedial actions. His work included evaluation of the nature and the cause of the harm associated with approximately a dozen areas of contamination and three distinct plumes of ground-water contamination along with an evaluation of the history of operations and releases at the site and the nature of and timing of paint manufacturing waste recycling at the facility. Mr. Rosasco also performed an evaluation of the most likely source of contamination in one of the facility supply wells based on an evaluation of the timing of historical releases at the facility and a comparison of the chemical composition of the historical releases to the contamination found in the well. This resultant opinions were further supported by the results of both analytical and numerical models of ground-water flow and chemical transport performed by me. Mr. Rosasco prepared three separate expert reports covering various aspects of his work, a written summary of his trial testimony and provided expert testimony during two separate depositions in this matter and at trial.

11. Michigan Avenue National Priorities List Site, Kalamazoo, MI

    Mr. Rosasco evaluated the various response activities and related costs incurred by the current owner of the site in conjunction with cost recovery actions between the current owner, the previous owner/operator and surrounding industrial facilities related to regional ground-water contamination at this site. His project work include an evaluation of site conditions, the nature and extent of contamination, past and future remedial actions and past response costs. Mr. Rosasco performed an analysis of the necessity and consistency with the NCP of the past response costs, prepared an expert report presenting his opinions and the basis for his opinions and provided deposition testimony.

12. Galley Road Removal Action, Colorado Springs, Colorado

Mr. Rosasco performed evaluations of the nature and extent of wastes and contamination at this former dumping site that lead EPA to require a removal action for this facility. Mr. Rosasco also evaluated the fate and transport properties of these wastes and the associated hazardous substances. His evaluations including determining what hazardous substances were present as a result of disposal of foundry wastes at the site. These were compared to the list of hazardous substances identified by EPA's Action Memorandum to evaluate the need for and causes associated with the removal action. Mr. Rosasco also provided testimony related to the differences between RCRA "hazardous wastes" and CERCLA "hazardous substances.

13. Intalco Aluminum Plant, Ferendale, Washington

Mr. Rosasco provided expert testimony regarding the reasonableness and appropriateness of investigations and remediation of historic industrial waste landfills related at this primary aluminum reduction facility in Ferndale, Washington. Mr. Rosasco also provided testimony regarding the presence of hazardous substances, the applicability of the Washington Model Toxics Control Act to the investigations and remediation, and the costs of the investigations and remediation.

14. Lowry Landfill National Priorities List Site, Denver, Colorado

Mr. Rosasco provided expert testimony and assisted in cost recovery litigation between the industrial users and the owner/operators of this co-disposal (municipal and industrial waste) landfill. His project work was in part related to his prior involvement as the engineer-in-charge of RI/FS work at the facility and included expert assistance in development of anticipated defenses, technical assistance in the development of other expert's opinions, and coordination of other experts. His specific opinions included site conditions, the nature and extent of contamination, the anticipated remedial actions, the response costs incurred, the necessity and consistency of the response costs incurred by both Plaintiffs and Defendants, and the contribution of hazardous constituents by municipal solid wastes and the impacts of solid waste landfill operations on the nature and extent of contamination and the need for, scope and cost of the various remedial actions. Mr. Rosasco prepared an expert report and provided expert testimony during deposition.

15. Phosphogypsum Stack, Tulsa County, Okalahoma

Mr. Rosasco conducted a review and provided testimony related to the consistency of the Remedial Investigation/Feasibility Study and other activities and associated costs relative to the National Contingency Plan for this State superfund site.

16. Noma Outdoor Products Facility, Jackson Tennessee

Mr. Rosasco provided expert analyses and expert testimony as part of a cost recovery action between the current and past owners and operators of this manufacturing facility related to ground-water contamination in the area. His project work included site inspections, ground-water monitoring, assessment of historic and modern operations and releases of hazardous substances at the facility, evaluation of the nature, extent, fate and transport of volatile organic compounds, saturated and unsaturated zone chemical transport modeling, evaluation of the technical quality of prior investigations and evaluations performed by other experts, and development and cost estimation of potential remedial actions. Mr. Rosasco provided expert testimony related to the potential sources of contamination, the estimated timing of historic releases, the reasonableness and degree of certainty of the analyses performed by opposing experts, the necessity and NCP consistency of "response actions" performed by others, and the adequacy of the various pre-acquisition evaluations in terms of the "Innocent Landowner Defense".

17. Retail Petroleum Outlet, Castle Rock, Colorado

Mr. Rosasco performed an evaluation of the nature and extent of ground-water contamination, known and potential sources of the contamination, fate and transport analyses including ground-water modeling, free-product characterization and transport and an assessment of variations in dissolved contaminant occurrences and concentrations over a ten year period along with evaluations of prior, ongoing and potential future remedial actions. Mr. Rosasco also evaluated the results of field investigations performed by opposing experts to identify the "source" of the contamination of a municipal supply well, the "contamination" of various private properties in the area, and their "basis" for eliminating other known releases as a source of the contamination. Mr. Rosasco prepared an expert report and provided expert testimony during deposition and at trial.

18. Buzby Landfill, Vorhees Township, New Jersey

Mr. Rosasco prepared and expert report and provided testimony related to the necessity and NCP consistency of past response costs incurred by the owner of this closed municipal landfill. His project work included an evaluation of site conditions and past response actions, summarization and evaluation of past response costs, and analysis of the consistency of these actions and costs with the requirements of the NCP related to private cost recovery.

19. Pasco Bulk Terminal Facility, Port of Pasco, Washington

Mr. Rosasco evaluated and prepared an expert report related to potential contribution and allocation of remedial costs associated with various bulk fuel storage and terminal operations at the Port of Pasco Washington. His evaluations included examination of the history and practices of the various operations in the area, the history of spills and other releases of oils and fuels as well as various industrial chemicals associated with these

various operations, the nature and occurrences of dissolved and free-phase product, the nature and occurrence of soil contamination and the influence of the hydrogeology of the area and the chemical properties on the chemical distributions and potential remediation activities.

20. Amoco refinery and downtown/north Casper groundwater contamination, Casper, WY.

    Mr. Rosasco provided expert testimony regarding the nature and extent of groundwater contamination associated with the petroleum refinery and several other sources of groundwater contamination including a railyard, dry cleaning facility, petroleum tank farm and retail gasoline station, among numerous others in the Casper area. Specifically, Mr. Rosasco evaluated soil, soil gas and groundwater data to identify the known and potential sources of groundwater contamination and the nature and extent of groundwater contamination. Mr. Rosasco also evaluated the appropriateness and efficacy of existing remedial measures and possible additional remedial measures being considered for the refinery. Mr. Rosasco also evaluated the possibility of occurrences of dense non- aqueous phase contamination beneath the refinery.

21. Conoco and Total Refineries, Commerce City, Colorado

    Mr. Rosasco provided expert testimony in conjunction with arbitration between the parties regarding costs associated with remediation efforts along Sand Creek. Mr. Rosasco reviewed current and historic documents related to the hydrogeologic conditions at, beneath and up-gradient of Sand Creek, the nature and extent of both dissolved and free-phase occurrences of petroleum hydrocarbons in the soil, sediments, surface water and ground water, the requirements associated with various the regulatory orders and correspondence, and the effectiveness and actual or anticipated costs of various different remediation scenarios as well as the effectiveness of the scenario ultimately implemented. Of key importance were the identification and mitigation of all possible mechanisms potential causing hydrocarbon seeps from the stream bank or sheens on the surface water of the creek. During a subsequent arbitration, Mr. Rosasco provided expert testimony relative to the need for, scope of and costs associated with a proposed subsurface barrier to contain free product and dissolved phase migration into or beneath Sand Creek and proposed realignment of the creek. Mr. Rosasco evaluated costs associated with construction of the new creek both with and without consideration of the previous temporary creek re-location.

    Mr. Rosasco also performed site investigations related to assessment of the source of free product occurrences and dissolved phase groundwater contamination beneath the Conoco and Colorado Refining Co. refineries. Based on the results of these evaluations and evaluations performed by other experts, Mr. Rosasco developed an assessment of the origin of the various free product occurrences and the dissolved phase groundwater plume. Mr. Rosasco prepared an allocation of the costs associated with free product recovery and dissolved phase groundwater remediation and presented the results of his investigations, evaluations and cost allocation at the arbitration hearing in this matter.

22. Former General Iron Works Foundry Facility, Denver, Colorado

Mr. Rosasco performed and supervised surface and subsurface investigations of this former foundry facility related to historic disposal of solid and hazardous wastes, PCB releases, leaking underground petroleum storage tanks, historic spills and releases of diesel fuel, and other historic operations in conjunction with cost recovery litigation between the current owner and the historic owner/operator of the facility. Mr. Rosasco also evaluated potential remedial actions and developed cost estimates for these actions as a basis for potential damages. Mr. Rosasco provided expert testimony on his investigations and evaluations during deposition and at various arbitration and settlement conferences.

23. Marshall Landfill National Priorities List Site, Boulder County, Colorado

Mr. Rosasco provided expert testimony during trial related to the nature and extent of contamination and the sources of contamination at this Superfund site along with testimony related to the nature and scope of historic gravel mining, landfill operations and waste disposal at this facility. Project work included performance of subsurface investigations related to the nature and configuration of refuse and other wastes disposed at the site, underlying occurrences of gravel and other materials and ground-water conditions. Related project work included project management and technical evaluations for the Remedial Investigation and Feasibility Study for site and senior consulting and technical review during the Remedial Design and Remedial Action phases at the site.

24. Talache Mine Tailings Site, Atlanta Mining District, Idaho

Mr. Rosasco reviewed information related to site conditions, ownership and operation, causation factors and remediation requirements associated with the 1996 failure of the Talache Mine Tailings pile. Mr. Rosasco provide expert testimony regarding potential cost allocation between the various parties including both past and current owners and operators and the factors affecting the equity of various allocation methods developed by him and by other experts.

25. Oil and Gas Production Unit, Aztec, New Mexico

Mr. Rosasco offered expert opinions regarding the sources of contamination at an oil and gas production site in northwestern New Mexico. Specifically, Mr. Rosasco evaluated soil and groundwater data and performed an onsite inspection during remediation activities. The purpose of his work was to assess the nature and extent of contamination and the relative contributions of contamination from the produced water disposal pit and equipment associated with the oil and gas production facilities as compared to the natural gas dehydrating equipment and associated pit. Mr. Rosasco provided testimony at New Mexico Oil Conservation Division hearings.

26. Retail Gasoline Outlet, Adams County, Colorodo

Mr. Rosasco was retained by counsel for both parties involved in a dispute regarding the need for and scope of potential remediation activities to address gasoline contamination in soil and groundwater and associated vapors in a building adjacent to a retail gasoline outlet. Mr. Rosasco review information provided by both parties and evaluated both parties proposals. Mr. Rosasco subsequently met with both parties and provided his findings which resulted in settlement of the dispute.

27. Explosive Manufacturing Facility, Spanish Fork, Utah

Mr. Rosasco provided expert assistance regarding allocation of costs incurred for assessment and remediation of onsite soil and groundwater and offsite groundwater contamination from an explosive manufacturing facility in Utah. Mr. Rosasco reviewed the history of operations and known releases at the Site, the results of prior and ongoing investigations and monitoring activities, prior and ongoing remediation efforts, and associated documents prepared in response to various State orders including a RCRA Corrective Action Order. Mr. Rosasco developed cost allocation models and procedures for demolition of historic facilities, onsite soil contamination, onsite and offsite groundwater contamination and ongoing groundwater remediation activities.

28. Retail Gasoline Outlet and Car Wash, Jefferson County, Colorado

Mr. Rosasco evaluated the investigation and remediation costs incurred by a car wash facility located adjacent to leaking underground storage tanks at an adjacent gasoline station. Mr. Rosasco also evaluated other potential sources of contamination in the area. Mr. Rosasco provided expert testimony at trial regarding the need for and reasonableness of the costs incurred in conjunction with the response actions taken by the car wash facility.

In addition to the projects described above, Mr. Rosasco have also performed several site segregation evaluations of multiple facility Superfund sites to identify potential sources and contributors to regional ground-water contamination and/or to eliminate particular facilities as sources of some or all of the contamination. Project work has included review of regulatory records and the results of historic investigations and sampling activities, aerial photographic interpretation, ground-water monitoring and assessment of hydrogeologic conditions, fate and transport analyses including ground-water flow and transport modeling and geochemical “fingerprinting”. Example projects include the South Valley of Albuquerque, New Mexico National Priorities List Site, the Sand Creek Industrial Area NPL Site in Denver, Colorado, and the Southeast Rockford Ground-water Contamination Area, NPL Site, Rockford, Illinois. These projects were performed in conjunction with responses to CERCLA 104E notices or 106 Orders or as part of Remedial Investigations / Feasibility Studies to reduce the scope and cost of future remedial actions for which his clients may be required to pay.

Attachment 2

List of Documents Reviewed and Relied On

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Attachment 3

Summary Exhibits

Table 1 Cadmium, Lead, and Zinc Concentrations
in Ballast Sample Composites

Location	Cadmium	Lead	Zinc	Ratio Zn/Cd
HRR-01	3.3	11000	130	39.4
HRR-02	31	13000	1400	45.2
HRR-03	23	5900	860	37.4
HRR-04	16	14000	880	55.0
HRR-05	120	6400	4500	37.5
HRR-06	13	8200	430	33.1
HRR-08	21	14000	710	33.8
HRR-09*	0.82	250	230	280.5
HRR-10	9.9	1800	330	33.3
HRR-11	1.7	9000	58	34.1
HRR-12	20	17000	680	34.0
HRR-12A*	25	11000	890	35.6
HRR-14	9.6	4200	340	35.4

Notes: • HRR-09 excluded from comparisons in Section 3.0 Summary. HRR-12A is a Duplicate of HRR-12.

Source: Table 3 from NewFields January 29, 2007 Historic Railroads – St. Francois County Mined Areas report.

Table 2
Soil Sampling Analytical Results (Total Metals and SPLP Metals)
Bonne Terre, MO
November 1, 2013

Sample Number	Depth Interval (feet)	Sample Date	Cadmium	Cadmium SPLP (mg/l)	Lead	Lead SPLP (mg/l)	Zinc	Zinc SPLP (mg/l)
SB-1	0.0 - 0.5	1-Nov-13	52.9	J 0.0006	16,600	0.0927	2,830	0.055
	0.5 - 1.0		60.7	< 0.002	18,100	J 0.0069	3,530	J 0.0069
SB-2	0.0 - 0.5	1-Nov-13	D 24	< 0.002	D 13,900	< 0.04	D 893	J 0.0052
	0.5 - 1.0		D 17.2	< 0.002	D 8,850	< 0.04	D 674	J 0.0067
SB-3	0.0 - 0.5	1-Nov-13	16.7	0.0021	19,500	1.03	777	0.154
	0.5 - 1.0		17.1	0.0037	8,840	2.1	730	0.342
SB-4	0.0 - 0.5	1-Nov-13	D 15.9	< 0.002	D 9,770	J 0.0065	D 718	J 0.0068
	0.5 - 1.0		D 11.5	< 0.002	D 16,600	J 0.023	D 521	J 0.006
Consensus Based PEC, MacDonald, et al. 2000			4.98	NG	128	NG	459	NG
MRBCA Eco-Risk Water Quality Criteria, April 200			NA	0.0002	NA	0.001	NA	0.059

Notes:

<: Value below reporting limit.
J: Analyte detected below quantitation limits.
NG: No guideline published.
NA: Not applicable.
D: Dilution factor applied.
Highlighted cells exceeded a PEC or MRBCA Eco-Risk Water Quality Criteria.
MRBCA Missouri Risk Based Corrective Action Guidance Document, Table 5-1 Eco-Risk Assessment Chemicals and Targel Levels Chemicals of Concern with Protection of Aquatic Life (AQL) - chronic values
SPLP Synthetic Precipitation Leaching Procedure (USEPA Method 1312)

1. Total metals analysis and analysis of leachate by USEPA Method 6010B/7470A
2 The detection limit for lead in SB-2 is 0.04 mg/l which exceeds the MRBCA Eco-Risk Water Quality Criteria of 0.001 mg/l.
3 The detection limit for cadmium was 0.002 mg/l which exceeds the MRBCA Eco-Risk Water Quality Criteria of 0.0002 mg/l.

Table 3
Solids Sampling Analytical Results (Total Metals and SPLP Metals)
Leadwood, MO
November 8, 2013

Sample Number	Depth Interval (feet)	Sample Date	Cadmium	Cadmium SPLP (mg/l)	Lead	Lead SPLP (mg/l)	Zinc	Zinc SPLP (mg/l)
SB-5	0.0 - 0.5	8-Nov-13	0.23	< 0.002	43.9	J 0.014	49.7	0.0279
	0.5 - 1.0		0.28	< 0.002	54.5	J 0.014	55.7	0.0267
SB-6	0.0 - 0.5	8-Nov-13	0.29	< 0.002	46.3	J 0.0092	44.2	0.0147
	0.5 - 1.0		0.29	< 0.002	50.5	J 0.018	47	0.0203
Consensus Based PEC, MacDonald, et al. 2000			4.98	NG	128	NG	459	NG
MRBCA Eco-Risk Water Quality Criteria, April 2006			NA	0.0002	NA	0.001	NA	0.059

Notes:

<: Value below reporting limit.
J: Analyte detected below quantitation limits.
NG: No guideline published.
NA: Not applicable.
D: Dilution factor applied.
Highlighted cells exceeded a PEC or MRBCA Eco-Risk Water Quality Criteria.
MRBCA Missouri Risk Based Corrective Action Guidance Document, Table 5-1 Eco-Risk Assessment Chemicals and Targel Levels Chemicals of Concern with Protection of Aquatic Life (AQL) - chronic values
SPLP Synthetic Precipitation Leaching Procedure (USEPA Method 1312)
1. Total metals analysis and analysis of leachate by USEPA Method 6010B/7470A
2 The detection limit for cadmium was 0.002 mg/l which exceeds the MRBCA Eco-Risk Water Quality Criteria of 0.0002 mg/l.

Table 4
Solids Sampling Analytical Results (Total Metals and SPLP Metals)
Fredericktown, MO
November 21, 2013

Sample Number	Depth Interval (feet)	Sample Date	Cadmium	Cadmium SPLP (mg/l)	Lead	Lead SPLP (mg/l)	Zinc	Zinc SPLP (mg/l)
SB-7	0.0 - 0.5	21-Nov-13	2.97	< 0.002	1,180	0.0518	349	0.0276
	0.5 - 1.0		3.03	J 0.0003	1,380	0.0635	440	0.0389
SB-8	0.0 - 0.5	21-Nov-13	3.91	< 0.002	1,270	0.0838	230	0.0214
	0.5 - 1.0		2.05	< 0.002	1,290	0.104	153	0.0226
SB-9	0.0 - 0.5	21-Nov-13	0.38	< 0.002	770	0.072	60.9	0.0143
	0.5 - 1.0		0.4	< 0.002	1,140	0.0752	61.9	0.0138
Consensus Based PEC, MacDonald, et al. 2000			4.98	NG	128	NG	459	NG
MRBCA Eco-Risk Water Quality Criteria, April 2006			NA	0.0002	NA	0.001	NA	0.059

Notes:

<: Value below reporting limit.
J: Analyte detected below quantitation limits.
NG: No guideline published.
NA: Not applicable.
D: Dilution factor applied.
Highlighted cells exceeded a PEC or MRBCA Eco-Risk Water Quality Criteria.
MRBCA Missouri Risk Based Corrective Action Guidance Document, Table 5-1 Eco-Risk Assessment Chemicals and Targel Levels Chemicals of Concern with Protection of Aquatic Life (AQL) - chronic values
SPLP Synthetic Precipitation Leaching Procedure (USEPA Method 1312)
1. Total metals analysis and analysis of leachate by USEPA Method 6010B/7470A
2. Arsenic, mercury, selenium and silver were not detected using SPLP analysis.
3 The detection limit for cadmium was 0.002 mg/l which exceeds the MRBCA Eco-Risk Water Quality Criteria of 0.0002 mg/l.